5.0 GROUNDWATER TREATMENT SYSTEM

5.1 OPTIONS AND SELECTION

Potential options for components of a groundwater treatment system along the northern boundary of the Priceless Gas Site were identified in Section 2.0 of this Work Plan. Elements of each of the identified technologies are included in the design of the groundwater treatment system to provide operational flexibility. The system components, constructed in an east-west trending trench, include:

- Engineered backfill in the treatment trench
- Horizontal air injection and extraction piping
- Vertical monitoring, extraction and/or injection piping
- Vapor and effluent treatment
- Bioenhancement delivery system
- Geomembrane cover
- Groundwater collection line on the west side of the trench

5.2 SYSTEM DESIGN AND CONSTRUCTION

The groundwater treatment system consists of the following components, described in detail in the following, and shown in plan view (Figure 3) and cross-sectional schematic details (Figure 5).

All construction and monitoring activities will follow the ***Health and Safety Plan*** requirements for the Site, provided in Appendix C.

5.2.1 Groundwater Treatment Trench

The groundwater treatment system will be constructed within a trench excavated south of the alleyway (and underground utility corridor) along the north boundary of the Site (refer to Figure 3). Although some subsurface information is available related to trench depth and length (based on the bedrock and topographic contour maps provided in Appendix A of this ***Work Plan***), the trench excavation will be guided by the following criteria and constraints:

- Sufficient lateral separation needs to be maintained between the alleyway utility corridor and the northern boundary of the trench.
- The treatment trench will be excavated to bedrock and follow (as much as feasible) the former location and lateral extent of the removed 12,000-gallon and 10,000-gallon tanks.
- Minimum trench width at the base will be approximately 10 feet.
- Excavation will likely encounter the old septic tank (approximate location shown on Figure 3), which will need to be removed or stabilized in place.

Excavated soils will be stockpiled for potential use as backfill (dependent upon suitability). Any stockpiled soils not used for backfill will be screened for the presence of contamination and disposed of in an appropriate manner.

Following excavation, the trench sidewalls and base will be lined with a geotextile prior to pipe installations (discussed in the following section). The trench will be backfilled with a specified soil media, having the appropriate characteristics (and subjected to pre-construction data collection). Backfill material needs to be homogeneous and isotropic and may incorporate ORC, if required.

A geomembrane cover will be installed over the top of the trench (refer to Figure 5) and covered with clean site soils to anchor in place. All pipe penetrations through the trench cover will be booted.

5.2.2 Trench Monitoring, Air Injection/Extraction, and Treatment Systems

The pipe installation within the trench includes three components to provide for flexibility in treatment options and operations (refer to Figure 5):

- Along the base of the trench horizontal perforated (and wrapped with geotextile) pipe for oxygen introduction via air injection;
- Running along the top of the trench (beneath the geomembrane cover), horizontal perforated pipe for vapor extraction;
- Manifolded vertical perforated pipe (diameter and spacing to be determined during pre-construction data collection) for monitoring groundwater levels within the trench as well as potential use as extraction and/or injection ports. Monitoring ports will be booted through the trench geomembrane cover and secured using utility vaults (meter boxes, or equivalent).

All horizontal pipe components will be capped (on the west end of the trench) and valved on the east end of the trench. Air injection, vapor/effluent treatment, and pumping system equipment will be housed on the east end of the trench (proximity to power) and south of the Site boundary to maintain access through the alleyway and to the utility corridor.

Vapors will be treated using activated carbon adsorption. Any extracted groundwater will be treated using activated carbon adsorption, biofiltration, or equivalent and re-injected. Groundwater and air treatment media (filtration) will consider impacts on both BTEX and MTBE attenuation characteristics.

5.2.3 Groundwater Collection System

The configuration and lateral extent of the treatment trench is intended to utilize existing subsurface drainage channels and groundwater pooling areas created during installation of the diesel and gasoline storage tanks for operation of the Priceless Gas facility.

Outside the treatment trench area to the west, groundwater will be collected in a drainage gallery and conveyed to the treatment trench (refer to Figure 6).

The drainage gallery will be constructed within a trench excavated south of the alleyway (and underground utility corridor) along the north boundary of the Site. Although some subsurface information is available related to gallery depth and length (based on the bedrock and topographic contour maps provided in Appendix A of this ***Work Plan***), the excavation will be guided by the following limitations and constraints:

- Sufficient lateral separation needs to be maintained between the alleyway utility corridor and the northern boundary of the trench.
- The drainage gallery will be excavated to bedrock and the base of the excavation needs to maintain a minimum slope of 1% towards the treatment trench for gravity conveyance.
- Minimum width at the base of the drainage gallery will be approximately 2 feet.
- Excavation will likely encounter the old septic tank (approximate location shown on Figure 3), which will need to be removed or stabilized in place.

Excavated soils will be screened for contamination using visual observation and PID (photoionization detector) measurements. Contaminated soil will be temporarily stockpiled on visqueen and covered prior to transporting offsite to an appropriate disposal facility. Clean onsite soils will be segregated from contaminated soils and used for backfill onsite. Additional clean soil for backfill will be imported from an approved source.

Following excavation, the trench sidewalls (including the interface with the treatment trench) and base will be lined with a geotextile prior to pipe installation. Horizontal perforated pipe, wrapped with geotextile, will be installed along the base of the gallery maintaining a minimum slope of 1% to ensure gravity drainage into the treatment trench along the southern edge and upgradient of the air injection pipe (refer to Figures 5 and 6). The trench will be backfilled with pea gravel and stockpiled clean site soils.

Following construction of the product recovery system and groundwater treatment trench, the Site will be graded to promote surface water runoff and compacted with small mechanical or vibratory compactors or wheel rolled in accordance with WSDOT Standard Specifications Method A [2-03.3(14)C]. The groundwater treatment and collection trenches as well as the area around the product recovery vault should be compacted using a small mechanical or vibratory compactor.

5.3 SYSTEM OPERATIONS and MAINTENANCE

The groundwater treatment system is designed to operate in several modes to provide operational flexibility and increasing levels of treatment:

Level I: Air injection and passive vapor movement and treatment.
Level II: Air injection, active vapor extraction and treatment, and re-injection of air.
Level III: Air and nutrient injection, active vapor extraction and treatment, and re-injection of air.
Level IV: Air and nutrient injection, groundwater extraction and treatment, and vapor extraction and treatment.

System operations will be initiated using Levels I and II and monitored for performance and potential adverse impacts. The following components will be monitored, as required:

- Air injection system
- Vapor extraction system
- Groundwater level and concentrations in trench
- Benzene vapor concentrations and groundwater seepage in Dehn residence (basement)
- Groundwater level, BTEX and MTBE concentrations, and vapor (benzene) monitoring in wells MW-1, MW-2, and MW-4

As needed, additional components can be activated to increase the level of treatment and/or mitigate any adverse impacts.